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(71) Applicant(s)
Spectral Technology Limited

(Incorporated in the United Kingdom)

667 Ajax Avenue, Slough Trading Estate, SLOUGH, Berkshire, SL1 4DB, United Kingdom

(72) Inventor(s)
Ronald Edward Knight

(74) Agent and/or Address for Service
R G C Jenkins & Co
26 Caxton Street, LONDON, SW1H ORJ, United Kingdom

(54) Lamp assemblies

(57) A lamp assembly comprises an elongate lamp 1 which emits both ultra-violet and infra-red radiation. The lamp 1 is disposed within a reflective housing 2 which serves to direct radiation from the lamp 1 towards a moving substrate which is to be dried or cured. An infra-red radiation filter 3 is provided in the form of a quartz tube containing flowing water.

The housing 2 is provided with two reflector elements 4 which can be pivoted about respective axes 5 so as to enable the relative proportions of ultra-violet and infra-red components in the radiation which emerges from the lamp assembly to be adjusted.

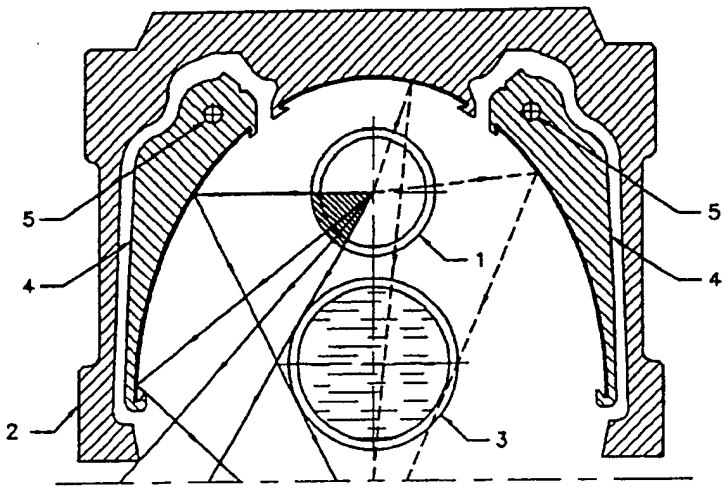

Fig. 3

IN FULLY OPEN MODE
APPROX 30% OF RADIATION UNFILTERED

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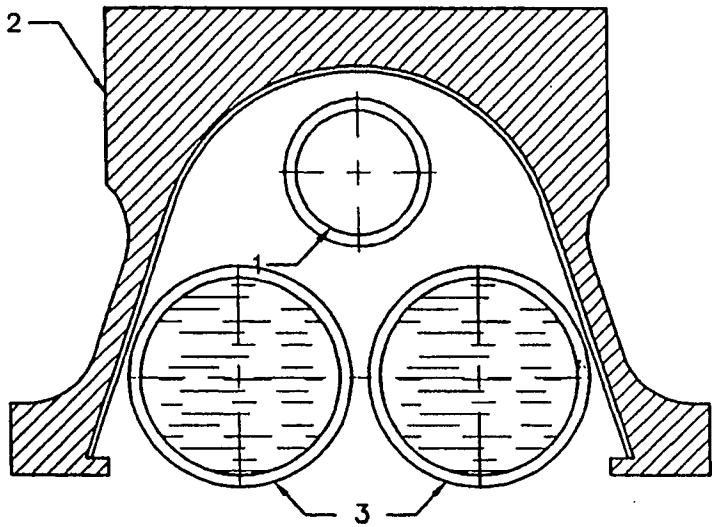

Fig. 1

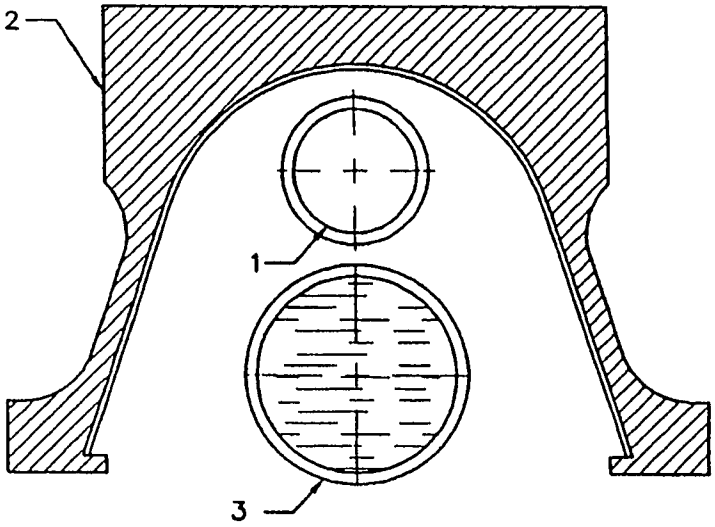

Fig. 2

CONVENTIONAL WATER FILTERED SYSTEMS

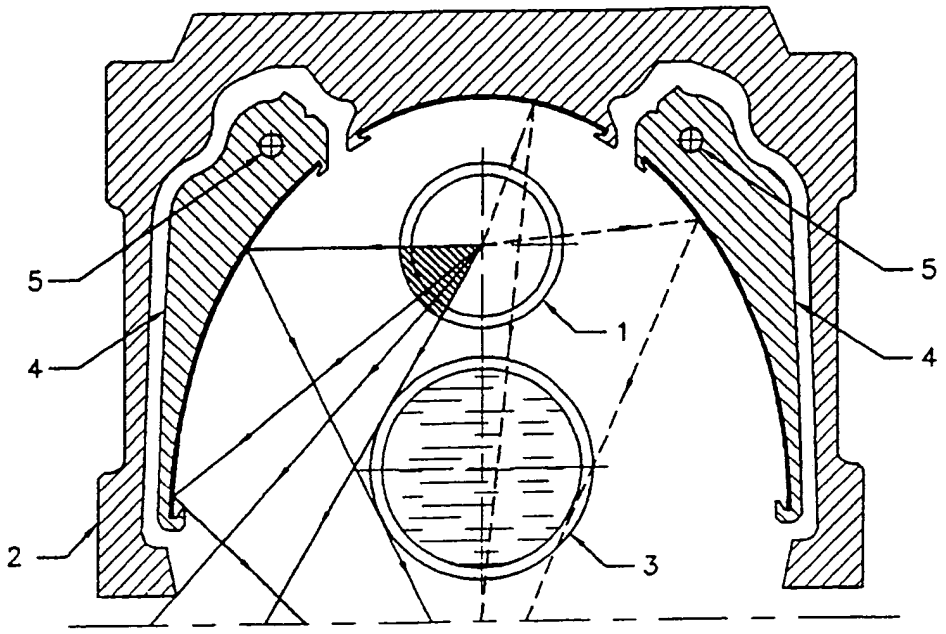

Fig. 3

IN FULLY OPEN MODE
APPROX 30% OF RADIATION UNFILTERED

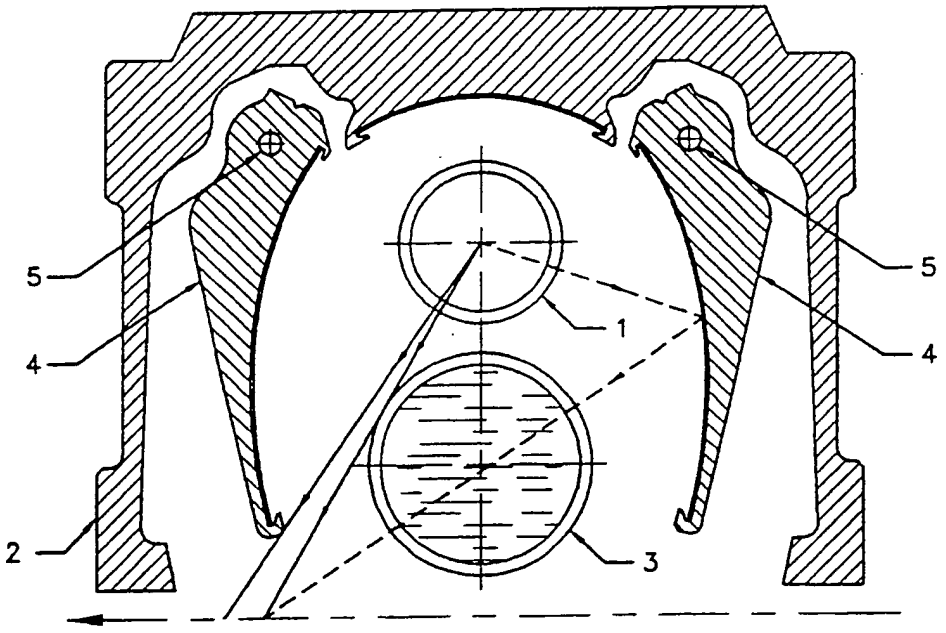

Fig. 4

IN PARTIALLY CLOSED MODE
APPROX 6% OF RADIATION UNFILTERED

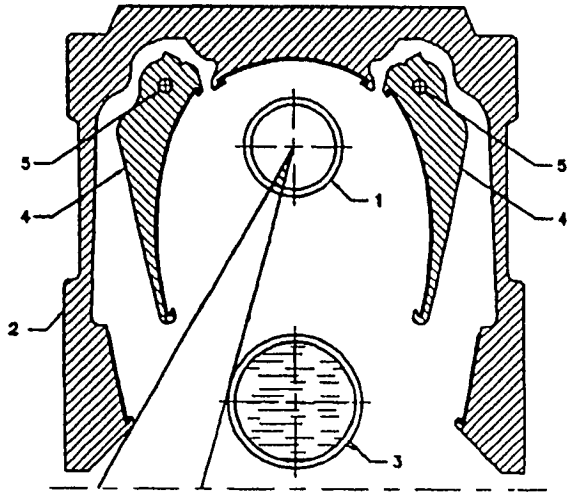

Fig. 5a

IN PARTIALLY CLOSED MODE
APPROX 6% OF RADIATION UNFILTERED

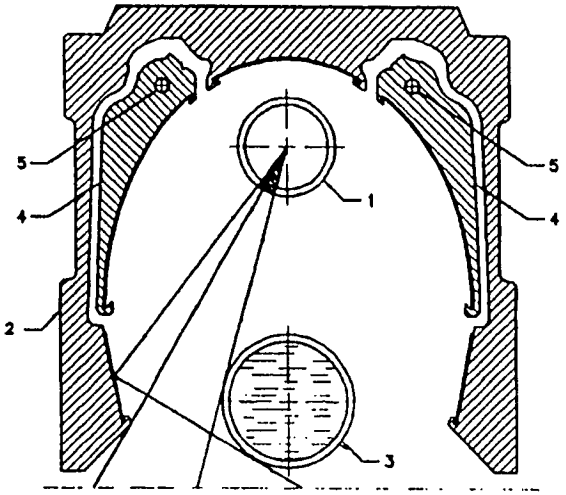

Fig. 5b

IN FULLY OPEN MODE
APPROX 30% OF RADIATION UNFILTERED

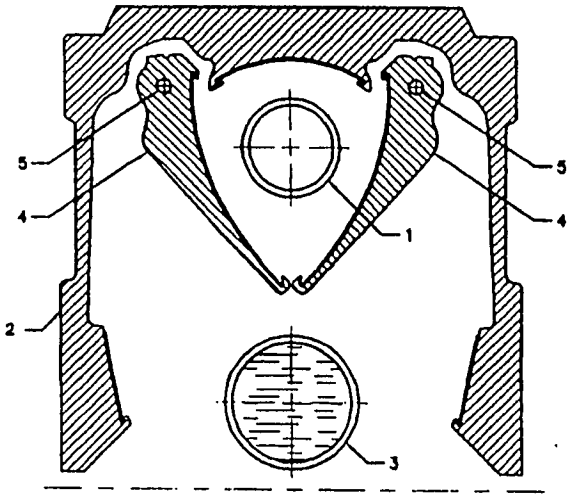

Fig. 5c

FULLY SHUTTERED

VARIATION WITH SHUTTERING

LAMP ASSEMBLY

The present invention relates to lamp assemblies and more particularly to lamp assemblies for use in the printing and coating industries for the fast drying or curing of inks and lacquers on a large variety of substrate materials. During the drying or curing process, the substrate is caused to move along a path such that successive strips of the substrate are irridated by an elongate lamp assembly in a continuous process.

Such lamp assemblies typically use ultra-violet light generated by high-powered lamps in a reflector system.

Such systems, however, generate a considerable proportion of infra-red energy, such as 60% of the total emitted radiation. Whilst this is generally beneficial in accelerating the curing process, the heat can be problematic in some applications where heat-sensitive materials are being handled.

A known solution to this problem is termed "water-filtration", wherein one or two tubes of quartz are typically provided between the lamp and the substrate and distilled de-ionised water passed through the tubes. This has the effect of filtering out approximately 50% of the infra-red radiation.

One problem with this arrangement, however, is that important short-wave ultra-violet radiation is also filtered out, and this therefore reduces the curing efficiency.

Where only heat-sensitive materials are being irradiated, the reduction in efficiency is an acceptable limitation, but users increasingly desire the flexibility to process a wide range of materials.

Furthermore, in many applications, such heat is only a problem when movement of the substrate commences, stops or when the substrate runs at low speeds.

A possible solution to this problem would be to provide removable water filter tubes or interchangeable reflector heads, but these are expensive and inconvenient and do not resolve the heat problems which occur during starting up and slowing down.

It would therefore be desirable to provide an arrangement which overcomes, or at least mitigates, the above-mentioned problems.

In accordance with a first aspect of the present invention there is provided a lamp assembly comprising a source of ultra-violet and infra-red radiation, means for directing a first proportion of the radiation through a filter and a second proportion so

as to by-pass said filter and means enabling at least one of said proportions to be varied so as thereby to control the relative amounts of ultra-violet and infra-red radiation emerging from the assembly.

In accordance with a second aspect of the present invention there is provided a method of controlling the relative proportions of ultra-violet radiation and infra-red radiation incident on a movable substrate in response to the sensed speed of movement of said substrate.

In order that the features and advantages of the present invention will be fully appreciated, preferred embodiments thereof will now be described with reference to the accompanying drawings, wherein:

Figures 1 and 2 illustrate in cross-section conventional lamp assemblies;

Figures 3 and 4 illustrate in cross-section a first embodiment of the present invention with moveable reflectors shown in two different positions; and

Figure 5 illustrates in cross-section a second embodiment of the present invention, wherein movable reflectors are operable as a shutter device.

Examples of conventional lamp assemblies are shown in Figures 1 and 2. In these arrangements an elongate ultra-violet lamp 1, which also emits infra-

red radiation, is arranged within an elongate reflective housing 2. One or more quartz tubes 3, through which distilled de-ionised water is passed, are also provided within the housing 2 such that a large proportion of the radiation from the lamp 1 passes through the water in the quartz tubes 3.

The water serves to filter out a substantial proportion of the infra-red radiation which is emitted by the lamp 1.

Figures 3 and 4 show a first embodiment of the present invention, which has the same components as those shown in Figures 1 and 2 represented by the same reference numerals. In this arrangement, two reflector elements 4 are pivotably mounted about respective axes 5. In the positions of these elements shown in Figure 3, a large proportion of the radiation emitted by the lamp 1 emerges from the lamp assembly without passing through the water filter 3, such that the emergent radiation contains a relatively high proportion of infra-red radiation.

In contrast, in the positions of the reflectors 4 shown in Figure 4, a smaller proportion of the radiation emitted from the lamp 1 emerges unfiltered from the lamp assembly, for two reasons. Firstly, the positions of the reflectors 4 are such that only radiation emitted by the lamp 1 within a narrow

angular range can by-pass the filter 3. Secondly, the proportion of light reflected by the reflector elements 4 into the filter 3 is greater than in the situation shown in Figure 3.

In a second embodiment, shown in Figure 5, the quartz tube 3 is positioned further away from the lamp 1 than in the arrangement shown in Figures 3 and 4, and this enables the reflectors 4 to adopt a fully closed state which effectively prevents all of the radiation emitted by the lamp 1 from emerging from the lamp assembly.

In both of the above-described embodiments, the reflectors are moved by means of an electric motor (not shown). The positions of the reflectors 4 are sensed by a position sensor (not shown), and the sensor output is used to control the electric motor in a servo arrangement such that the reflectors 4 are always in the desired position.

The desired position of the reflectors 4 will in practice depend on the nature of the substrate being dried or cured and on the speed at which the substrate moves past the lamp assembly. Thus, in the arrangements described above, a speed sensor is advantageously provided which generates an electrical output signal in dependence on the speed of the moving substrate and supplies this to control circuitry for

controlling the electric motor. The resulting system will cause the reflectors 4 to adopt the position shown in Figure 4 or Figure 5(a) when the substrate is running at a low speed or when starting up or stopping, and, when running at full speed, the reflectors 4 will adopt the position shown in Figure 3 or Figure 5(b). Furthermore, when the apparatus is being used to dry or cure a heat-sensitive substrate, the partially closed mode shown in Figure 4 and Figure 5(a) would be adopted.

When the system is in an idling situation, the fully shuttered mode shown in Figure 5(c) is adopted.

Although preferred embodiments of the present invention have been described above, it will be clear to persons skilled in the art that a number of alternative arrangements would be possible without departing from the scope of the present invention. For example, although an electric motor is provided in the preferred embodiments for controlling the position of the reflectors, it would be possible to effect such control either manually or pneumatically. Furthermore, although the position of the reflectors is preferably sensed directly, it would be possible to deduce the position by measuring the infra-red radiation emitted by the lamp assembly.

CLAIMS:

1. A lamp assembly comprising a source of ultra-violet and infra-red radiation, means for directing a first proportion of the radiation through a filter and a second proportion so as to by-pass said filter and means enabling at least one of said proportions to be varied so as thereby to control the relative amounts of ultra-violet and infra-red radiation emerging from the assembly.

2. A lamp assembly as claimed in claim 1, wherein said enabling means comprises means for directing a portion of the radiation emitted by the source selectively either through said filter or so as to by-pass said filter.

3. A lamp assembly as claimed in claim 1 or claim 2, wherein said enabling means comprises a movable optical element.

4. A lamp assembly as claimed in claim 3, wherein said optical element is a reflector.

5. A lamp assembly as claimed in claim 3 or claim 4, wherein said optical element is arranged to pivot about an axis.

caused to move relative to said assembly, the apparatus further comprising means for sensing the speed of relative movement and for controlling said enabling means in response thereto.

13. A method of controlling the relative proportions of ultra-violet and infra-red radiation incident on a movable substrate in response to the sensed speed of movement of said substrate.

14. A lamp assembly substantially as hereinbefore described with reference to Figures 3 and 4 or Figure 5 of the accompanying drawings.

15. A method of controlling the relative proportion of ultra-violet and infra-red radiation incident on a movable substrate substantially as hereinbefore described with reference to Figures 3 and 4 or Figure 5 of the accompanying drawings.

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Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9324695.7
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Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ON-LINE DATABASE: WPI	Documents considered relevant following a search in respect of Claims :- 1-12, 14 AND 15

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